Electronic Version

Stylesheet Version v1.1.1

Claims

[c1] 1. A white light light emitting diode (LED), comprising:
an exciting light source, for emitting a light, wherein a wavelength of the light is in a range of about 250nm to about 490nm; and
a fluorescent powder, disposed around the exciting light source, for absorbing the light emitting from the exciting light source, wherein a material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:Tb^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c2] 2. The white light LED of claim 1, wherein when the wavelength of the light is in a range of about 440nm to about 490nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$ and $Mg_3SiO_4:Mn$.

[c3] 3. The white light LED of claim 1, wherein when the wavelength of the light is in a range of about 250nm to about 440nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:TB^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$,$(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c4] 4. The white light LED of claim 1, wherein $0<x\leq0.8$ and $0\leq y\leq2.0$.

[c5] 5. The white light LED of claim 1, wherein Me comprises calcium, strontium, or barium.

[c6] 6. The white light LED of claim 1, wherein Re comprises praseodymium (Pr), rubidium, samarium (Sm), dysprosium (Dy), holmium (Ho), yttrium, erbium (Er), europium (Eu), thulium (Tm), ytterbium (Yb), chromium, strontium, lutetium (Lu), gadolinium (Gd), aluminum, or zinc.

[c7] 7. The white light LED of claim 1, wherein the exciting light source comprises LED chip or laser diode chip.

[c8] 8. A white light light emitting diode (LED), comprising:

a susceptor, having a pit in a surface of the susceptor;
an exciting light source, disposed in the pit of the susceptor and electrically connected to the susceptor, wherein a light having a wavelength in a range of about 250nm to about 490nm is emitted from the exciting light source;
a sealing resin, disposed over the susceptor, wherein the exciting light source is covered by the sealing resin to mount the exciting light source over the susceptor; and
a fluorescent powder, disposed in the sealing resin, and for receiving the light emitting from the exciting light source, wherein a material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O12$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:TB^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c9] 9. The white light LED of claim 8, further comprising:
a plurality of welding wire, electrically connected between the exciting light source and the susceptor.

[c10] 10. The white light LED of claim 8, wherein the susceptor comprises a packaging leadframe or a circuit board.

[c11] 11. The white light LED of claim 8, wherein the exciting light source comprises a LED chip or a laser diode chip.

[c12] 12. The white light LED of claim 8, wherein when the wavelength of the light is in a range of about 440nm to about 490nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, and $Mg_3SiO_4:Mn$.

[c13] 13. The white light LED of claim 8, wherein when the wavelength of the light is in a range of about 250nm to about 440nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:TB^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c14] 14. The white light LED of claim 8, wherein $0<x\leq0.8$, and $0\leq y\leq2.0$.

[c15] 15. The white light LED of claim 8, wherein Me comprises calcium, strontium, or barium.

[c16] 16. The white light LED of claim 8, wherein Re comprises praseodymium (Pr), rubidium, samarium (Sm), dysprosium (Dy), holmium (Ho), yttrium, erbium (Er), europium (Eu), thulium (Tm), ytterbium (Yb), chromium, strontium, lutetium (Lu), gadolinium (Gd), aluminum, or zinc.

[c17] 17. A white light light emitting diode (LED), at least comprising:
a LED chip, for emitting a light having a wavelength in a range of about 250nm to about 490nm, wherein the LED chip comprising:
a substrate;
an nucleation layer, disposed over the substrate;
a conductive buffer layer, disposed over the nucleation layer;
a first confinement layer, disposed over the conductive buffer layer, wherein a type of a (conductive) doping material of the first confinement layer and a type of a (conductive) doping material of the conductive buffer layer are the same;
a light emitting layer, disposed over the first confinement layer, wherein the light emitting layer comprises doped III-V compound semiconductor material;
a second confinement layer, disposed over the light emitting layer, wherein a type of the (conductive) doping material of the second confinement layer and the type of

the (conductive) doping material of the first confinement layer are different;

a contact layer, disposed over the second confinement layer, wherein the contact layer comprises a superlattice structure material layer;

an anode electrode, disposed over the contact layer;

a cathode electrode, contacted to the conductive buffer layer, and isolated from the first and the second confinement layer, the light emitting layer, the contact layer and the anode electrode; and

a fluorescent powder, disposed around the exciting light source, and for receiving the light emitting from the exciting light source, wherein a material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:TB^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c18] 18. The white light LED of claim 17, wherein when a wavelength of the light is in a range of about 440nm to about 490nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O$

:Eu^{3+}, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$ and $Mg_3SiO_4:Mn$.

[c19] 19. The white light LED of claim 17, wherein when the wavelength of the light is in a range of about 250nm to about 440nm, the material of the fluorescent powder is selected from a group consisting of $(Tb_{3-x-y}Ce_xRe_y)Al_5O_{12}$, $(Me_{1-x-y}Eu_xRe_y)_3SiO_5$, $YBO_3:Ce^{3+}$, $YBO_3:TB^{3+}$, $SrGa_2O_4:Eu^{2+}$, $SrAl_2O_4:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Eu^{2+}$, $(Ba,Sr)MgAl_{10}O_{17}:Mn^{2+}$, $Y_2O_3:Eu^{3+}$, $Y_2O_3:Bi^{3+}$, $(Y,Gd)_2O_3:Eu^{3+}$, $(Y,Gd)_2O_3:Bi^{3+}$, $Y_2O_2S:Eu^{3+}$, $Y_2O_2S:Bi^{3+}$, $(Me_{1-x}Eu_x)ReS$, $6MgO,As_2O_5:Mn$, $Mg_3SiO_4:Mn$, $BaMgAl_{10}O_{17}:Eu^{2+}$ and $(Ca,Sr,Ba)_5(PO_4)_3Cl:Eu^{2+},Gd^{2+}$.

[c20] 20. The white light LED of claim 17, wherein $0<x\leq0.8$ and $0\leq y\leq2.0$.

[c21] 21. The white light LED of claim 17, wherein Me comprises calcium, strontium or barium.

[c22] 22. The white light LED of claim 17, wherein Re comprises praseodymium (Pr), rubidium, samarium (Sm), dysprosium (Dy), holmium (Ho), yttrium, erbium (Er), europium (Eu), thulium (Tm), ytterbium (Yb), chromium, strontium, lutetium (Lu), gadolinium (Gd), aluminum or zinc.

[c23] 23. The white light LED of claim 17, wherein a super high

conductivity material of the contact layer comprises strained layer superlattice (SLS) material.

[c24] 24. The white light LED of claim 23, wherein a conductive type of the contact layer and a conductive type of the second confinement layer are different.

[c25] 25. The white light LED of claim 23, wherein a conductive type of the contact layer and a conductive type of the anode electrode are different.

[c26] 26. The white light LED of claim 17, wherein the anode electrode comprises a conventional metal used in a semiconductor process and a multi-layer structure composed of a mixture of the conventional metal, wherein a total thickness of the anode electrode is equal to or less than 0.1μm.

[c27] 27. The white light LED of claim 26, wherein the anode electrode comprises a transparent conductive oxide (TCO), wherein the TCO comprises a N-type conductive material comprising indium tin oxide (ITO), cadmium tin oxide (CTO), ZnO:Al, ZnO:In, ZnO:Ga, $ZnGa_2O_4$, SnO_2:Sb, Ga_2O_3:Sn, $AgInO_2$:Sn and In_2O_3:Zn, or a P-type conductive material comprising $CuAlO_2$, LaCuOS, NiO, $CuGaO_2$ and $SrCu_2O_2$.

[c28] 28. The white light LED of claim 17, wherein the sub-

strate is comprised aluminum oxide, sapphire, silcon carbide (SiC), zinc oxide (ZnO), silicon substrate, gallium phosphide (GaP) or gallium arsenide (GaAs).

[c29] 29. The white light LED of claim 17, wherein the light emitting layer comprises a doped III-V compound semiconductor quantum well structure.

[c30] 30. The white light LED of claim 29, wherein the quantum well structure comprises doped III-V compound semiconductor comprising $Al_aIn_bGa_{1-a-b}N/Al_xIn_yGa_{1-x-y}N$, wherein $a,b\geq 0$; $0\leq a+b<1$; $x,y\geq 0$; $0\leq x+y<1$; $x>c>a$.

[c31] 31. The white light LED of claim 17, wherein the cathode electrode comprises Cr/Au, Cr/Pt/Au, Cr/WSiN/Au, WSi_x/Au, Ti/Si_x/Au, Ti/Au, Ti/WSi_x/Au, Ti/Al/Cr/Au, Ti/Al/Co/Au, Cr/Al/Cr/Au, Cr/Al/Pt/Au, Cr/Al/Pd/Au, Cr/Al/Ti/Au, Cr/Al/Co/Au, Cr/Al/Ni/Au, Pd/Al/Ti/Au, Pd/Al/Pt/Au, Pd/Al/Ni/Au, Pd/Al/Pd/Au,, Pd/Al/Cr/Au, Pd/Al/Co/Au, Nd/Al/Pt/Au, Nd/Al/Ti/Au, Nd/Al/Ni/Au, Nd/Al/Cr/Au Nd/Al/Co/A, Hf/Al/Ti/Au, Hf/Al/Pt/Au, Hf/Al/Ni/Au, Hf/Al/Pd/Au, Hf/Al/Cr/Au, Hf/Al/Co/Au, Zr/Al/Ti/Au, Zr/Al/Pt/Au, Zr/Al/Ni/Au, Zr/Al/Pd/Au, Zr/Al/Cr/Au, Zr/Al/Co/Au, TiNx/Ti/Au, TiNx/Pt/Au, TiNx/Ni/Au, TiNx/Pd/Au, TiNx/Cr/Au, TiNx/Co/Au TiWNx/Ti/Au, TiWNx/Pt/Au, TiWNx/Ni/Au, TiWNx/Pd/Au, Ti-

WNx/Cr/Au, TiWNx/Co/Au, NiAl/Pt/Au, NiAl/Cr/Au, NiAl/Ni/Au, NiAl/Ti/Au, Ti/NiAl/Pt/Au, Ti/NiAl/Ti/Au, Ti/NiAl/Ni/Au or Ti/NiAl/Cr/Au.